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i2home

i2home: Intuitive Interaction for Everyone with Home Appliances based on Industry Standards
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Deutsches Forschungszentrum für Künstliche Intelligenz	DFKI
Siemens C-LAB	SAG
Czech Technical University	CTU
Swedish Handicap Institute	HI
Meticube	MET
Access Technologies Group	ATG
VICOMTech	VIC
INGEMA–Instituto Gerontológico Matia	ING

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Copies of reports and other material can also be accessed via the project's administration homepage, <http://www.i2home.org>

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i2home (Intuitive Interaction for Everyone with Home Appliances based on Industry Standards) is a Specific Targeted Research Project funded by the 6th Framework Programme of the EU (Priority IST-2005-2.5.11 e-Inclusion). The 40-months research project started in September 2006 and finished in December 2009.

Project objectives

The EU-funded project i2home has taken a substantial step towards the long-term vision of an internet with built-in accessible, usable, feasible and affordable user interfaces for everyone. To reach this goal it is inevitable that the different stakeholders operating on the market firstly agree on some technology that secondly allows for realising accessible user interfaces. As we have witnessed in the last decades, agreed-upon platforms, protocols and technology automatically lead to affordability.

The i2home project's main objectives have been to implement a standards-based open platform called Universal Control Hub, or UCH for short, and use this platform to implement personal user interfaces for users with special needs so that they can interact with a smart home. This platform only requires that appliances and services are networked, i.e., a computer can communicate with them. In this way, it is possible to integrate not only traditional smart home appliances, such as lamps, heating etc. but also arbitrary software services, such as calendar/reminder systems or video conferencing systems. Within the project, several personal user interfaces have been evaluated in order to assess their feasibility, usability and accessibility. Many users were actively involved in the project by contributing to requirements on the user interfaces as well as evaluating them. They have been partially-sighted and blind persons, young persons with mild cognitive impairments, elderly persons and, finally, persons with Alzheimer's disease.

The project bases its efforts on industrial standards and mainstream technology: The Universal Remote Console (URC) technology is an international standard (ISO/IEC 24752). The implementation thereof is called the Universal Control Hub (UCH). Activity management, as implemented in i2home, has been standardised as industry standard (ANSI/CEA-2018). The project has also built upon some important mainstream technologies and networked appliances and services, such as Google calendar, Windows Media Center (WMC), and Siemens Serve@home kitchen appliances.

Highlights

i2home has been a successful project in many aspects. Here is a compilation of the most prominent highlights:

- i2home has shown that modern technology that is traditionally understood as being too complex even for many mainstream users can be made usable and enjoyable for people with special needs. This is done by providing personalised user interfaces that are targeted to the specific needs and preferences of individual users and user groups. People with special needs will greatly benefit from modern technology, such as heating and air conditioning, alarm systems, surveillance cameras, home automation, medical reminders, and time management assistance. The project has shown both the advantage for the users of such a system, and for their caregivers. For instance, the caregivers at the IZA care center in San Sebastian, caring about Alzheimer patients stated that they now regain the possibility to perform one of the Instrumental Activities of Daily Living.
- i2home has followed a User-Centred Design approach which has been successfully applied and



Figure 1: European commissioner Mr. Vladimír Špidla visiting the i2home booth at the European Day of People with Disabilities in Brussels in Dec 2009, European Commission.

customized in the context of users with special needs. The project has also contributed to the understanding of the needs and capabilities of persons with cognitive impairments. This user group is very diverse and requires flexible and adaptable user interfaces. Throughout the project, diverse user interfaces have been implemented and evaluated, such as, touch-screen based along with speech input/output, TV and simplified remote control, UIs on mobile phones (Windows mobile and Android), etc.

- i2home has taken several steps to ensure the continuity and further development of the Universal Remote Console (URC) technology. Firstly, the project has managed to provide sibling projects with its digital home software platform through the UCH Starter Kit, a software containing all components needed for a smooth jump start. Secondly, several i2home partners have succeeded in acquiring new projects partly based on the URC technology. Thirdly, with the URC Consortium, see www.openurc.org, the project has created an international platform for further development and marketing of the URC technology. Finally, industrial stakeholders have started to include the technology in their products and development strategies. All these efforts contribute to the growth and sustainability of the URC technology.



Figure 2: Joseph Schütz, Director Microprocessor & Programming Research Intel Corporation at the Intel/DFKI collaboration press conference at DFKI, Saarbrücken in December, 2009.

Contribution to the state of the art

i2home has been a pioneer in implementation and further development of standards on adaptive user interfaces in the center and vicinity of the Universal Remote Console technology. It has produced a software platform for the digital home that is fully devoted to the paradigm of personalised user interfaces. i2home leaves a legacy various user interfaces that can be used in other projects either as-is or as a model for the use and control of many networked devices and services.

In 2008, ISO/IEC 24752 was published as the international standard on URC to which i2home has made contributions before it reached Final Draft International Standard status under ISO/IEC JTC1. i2home has been active in the development of Technical Reports within the URC Consortium. These Technical Reports are instrumental for the establishment of a common platform of URC technology, and an open ecosystem on pluggable user interfaces and resources. Also, i2home has contributed to a European standard on user profiling, which is currently being developed within the European Telecommunications Standards Institute ETSI (see www.etsi.org).

Who will benefit from i2home and how

The main beneficiaries of the i2home project are citizens including people with special needs that need or would like smart home technology. By using standardised technology, the project envisions a large community fostering collaboration and competition that in the long run will increase the amount of offerings at lower prices. Furthermore, the technical architecture of the URC technology allows for adapting and

exchanging user interfaces, thus allowing everybody to use their preferred user interface.

Within the i2home project, the following main user groups have been addressed:

UG1: Elderly people Two main user groups including active persons taking courses at “the University of the Third Age”, and persons who have no or only little experience with modern technology.

UG2: Users with mild Alzheimer Persons classified as having GDS 3-5 (Reisberg’s Global Deterioration Scale), that is from “Mild Cognitive Impairment (MCI)” to “Moderate dementia”.

UG3: Young persons with cognitive impairments Active people wanting to live an independent life but having problems with comprehension of time and memory deficits.

UG4: Partially-sighted and blind persons Persons needing access to their digital home in order to live a better and more independent life.

As mentioned above, other projects are using the i2home technology and so the range of beneficiaries further extended, including people relying on brain-computer interfaces, and mainstream users. Additionally, the i2home technology is used and taught at universities thus providing researchers, teachers and particularly students with the opportunity of experiencing cutting edge research results.

Research Methodology



Figure 3: Our Personae: Arnost & Blanka (UG1), Manuela (UG2), Emma (UG3) and Mrs Grün (UG4).

The i2home project has mixed ingredients from several methodologies, such as User-Centred Design, Design for All, Adaptive Design Approach, Experience and Application Research, and the use of Personas. The perhaps most important approach has been to involve users right from the start: the users of the technology have been the driving force in the project. Therefore, all technical solutions are based on thorough investigations of the users, their needs and desires. Experience shows that technical personnel is not suited to deal with users directly since they don’t understand the language of the users, and vice versa. Therefore, we have employed usability experts that bridge between developers and users, and that write abstract descriptions of prototypical users, so-called *personas*, see figure 3. Based on the daily life of these personas along with a thorough investigation of state-of-the-art technology and realistic technical solutions, we have developed *scenarios* to optimally satisfy the users based on the opportunities as provided by the technical state of the art.

What do other people say about the i2home project?

Anonymous caregiver for an Alzheimer patient at IZA care center, San Sebastian, Spain:

“This is a technology I can trust.”

Ginger Claassen, (blind) accessibility specialist, Germany:

“Finally something that works! . . . if this technology will become adopted by many manufacturers, I could finally go appliance shopping like sighted people in a normal store, having the choice to buy cool and stylish appliances . . .”

Anonymous representant of the Emma persona, Uppsala, Sweden:

“It is good with this new technology—it is needed.”

“I like the touch screen, it is much simpler.”

Anonymous representant of the Arnost persona at CTU, Prague, Czech Republic:

“I want it right now, where can I buy it? How much is it?”

External i2home reviewers:

“The i2home project has initiated a European Ecosystem around the URC technology. This will provide a forum for strengthening capability to spread the technology at the European URC ecosystem level.”

“The project has provided good demonstrations of the technology developed and shown balanced collaboration between the project partners as well as synergies with other projects. The results so far are very promising and the exploitation potential is evident.”

Geoff Adams-Spink, Age & Disability Correspondent, BBC:

“I’m always looking for stories that will have a huge impact on the lives of ordinary people. I believe that when the i2Home project comes to fruition, the technology will deliver real improvements and increased independence to millions of people. From the BBC’s perspective, this is what makes it very interesting.”

Dr Martin Johnson, Director, The Thalidomide Trust, United Kingdom:

“Thalidomiders are now approaching their 50th birthdays and their bodies are beginning to wear out - having spent half a century performing extraordinary movements to accomplish everyday tasks. As a group, we worry about ageing and the maintenance of their independence. Assistive technologies like those developed by the i2Home project will play a major part in their lives in the next twenty to thirty years.”

Experiences

The i2home project has constituted a greatly motivated consortium with a high degree of commitment and engagement, producing results well above expectations. This is despite the fact that a standards-based approach for personalised user interfaces means a 180 degree change of direction compared to current practice of user interface development in industry. However, from a research perspective on domestic and European level, the approach has been more than welcome and obviously fills a need in many projects.

Initial problems in evaluation of the system were overcome through adaptation of the evaluation approach. The satisfaction and genuine interest of the participants taking part in compiling requirements as well as the evaluation has been striking and very encouraging.

Dissemination, Exploitation and Impact

Main dissemination activities have been more than 20 scientific papers on conferences and journals, see www.i2home.org for a complete list. Furthermore, the project has appeared at international exhibitions and meetings, such as:

- a demonstration of the URC technology and a multimodal user interface at CeBIT 2008 (www.cebit.de),
- a special section dedicated to the Persona approach in i2home at WUD (World Usability Day) in 2008.
- a session at the ICT meeting in Lyon, 2008
- a demonstration of the i2home system at the European Ministerial eInclusion Conference, Vienna 2008
- a demonstration of the i2home system at the European Day of People with Disabilities 2009, Brussels 2009.

Furthermore, at the time of writing this report it has been agreed that BBC will make a feature for broadcast on BBC World and BBC News. Also, a symposium dedicated to i2home and the URC technology has been accepted at ISG2010, the International Society for Gerontechnology 7th World Conference in Vancouver, Canada 2010.

The main exploitable results of the project are:

MET	UCH starter kit + Activity Management (CEA 2018) extension kit
VIC	Avatar, MCML and WMC TV extension kits
CTU	UI Protocol extension kit
SAG	Accessible UI extension kit
DFKI	Activity-Based Calendar (ABC)
DFKI	Multimodal UI

We have experienced an unexpected amount of impacts on different levels. Firstly, within the runtime of the project, a first step in injecting a world-wide ecosystem was taken by organising the very first

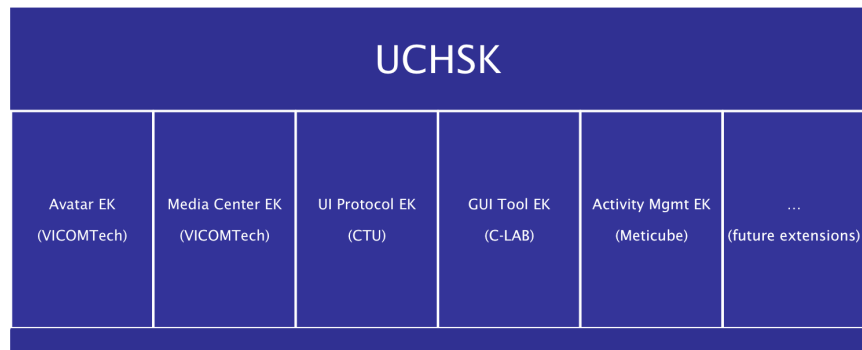


Figure 4: The UCH Starter Kit and its components.

international workshop of the URC Consortium (URCC) at DFKI's premises in Saarbrücken in September 2009. The workshop was attended by several i2home partners as well as representatives from USA and India. The main outcome of the workshop were:

- Complete new relaunch of the URC consortium
- Renaming / rebranding: “myURC” → “openURC”.
- Official webpage: <http://www.openurc.com>
- Commitment to establish a legal body for the URCC and the URC ecosystem with 3 Working Groups:
 - Governance (chaired by the Trace Center and co-chaired by DFKI)
 - Technology (chaired by Access Technologies Group and co-chaired by DFKI)
 - Marketing (chaired by Meticube and co-chaired by dotUI)

Furthermore, by creating the UCH Starter Kit, the project has managed to raise interest into the technology and we have experienced tenths of downloads from different stakeholders around Europe resulting in experiments and installations.

The i2home consortium

Deutsches Forschungszentrum für Künstliche Intelligenz, DFKI GmbH. DFKI brings experience in intelligent user interfaces and coordination to i2home.

Siemens AG C-Lab, SAG. C-Lab has a long experience in technology for disabled which is further underpinned by the inclusion of affected persons in the project. As a part of Siemens AG, C-Lab brings access to the CHAIN standard through the serve@home technology.

Czech Technical University in Prague, CTU. CTU brings competence in user interface design as well as access to elderly people.

Hjälpmedelsinstitutet, HI. HI is a national resource centre on assistive technology and accessibility for persons with disabilities. In i2home, HI is contributing as a user partner with access to young persons with mild cognitive disabilities.

Meticube, MET. MET is a sme focussing on software for Information Systems, Communication and Multimedia. Their contribution to i2home is the implementation of the UCH and Activity Management.

Access Technologies Group, ATG. ATG is the consortium's contact to international standards. Also, ATG is responsible for the technical coordination.

VICOMTech, VIC. Their long experience in digital TV makes VC a perfect partner for i2home. VC is responsible for the inclusion of consumer electronic (CE) products and has partly served as technical coordinator.

INGEMA, ING. The INGEMA foundation serves as a user partner and has access to several hundred beds for, in particular, Alzheimer patients.

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